

CLAIMS

What is claimed is:

1. A system for transporting data, comprising:

an input device that receives data from at least one input line and generates at least one supercell comprising a prescribed plurality of ATM cells;

a scheduling device that receives a request from said input device when said prescribed plurality of ATM cells has arrived at said input device, and generates a grant that instructs said input device to generate said at least one supercell; and

an output device that receives said at least one supercell via a crossbar switch and in accordance with said grant, wherein said supercell comprises one of only two classes and corresponds to said output device, and wherein a first of said two classes comprises selected ones of said plurality of ATM cells that conform to a minimum cell rate (MCR), and a second of said two classes comprises selected ones of said plurality of ATM cells that do not conform to said MCR.

2. The system of claim 1, wherein said input device generates said at least one supercell comprising conforming cells prior to generating a supercell comprising nonconforming cells.

3. The system of claim 1, further comprising a plurality of queues at said input device, each of said plurality of queues processing a quality of service class, corresponding to said output device.

4. The system of claim 3, further comprising a port selector that selects said request for transmission to said scheduler, receives said grant, and generates said supercell in accordance with said grant.

5. The system of claim 1, wherein said system is configured to support multicasting.

6. The system of claim 1, further comprising a back pressure signal generated from said output device to said scheduler, wherein said scheduler generates said grant in accordance with said back pressure signal.

7. The system of claim 1, wherein said scheduler does not require header information for each of said plurality of ATM cells.

8. The system of claim 1, wherein said output device deconstructs said supercell and generates an output.

9. The system of claim 1, wherein said input device transmits said request for a first of said two classes if said prescribed plurality of ATM cells conforming to a minimum cell rate has been received by said input device, and said input device transmits said request for a second of said two classes if said prescribed plurality of ATM cells not conforming to said minimum cell rate has been received by said input device.

10. The system of claim 9, further comprising a first-in, first-out (FIFO) queue that determines a priority of said prescribed plurality of ATM cells used to generate said supercell.

11. The system of claim 1, said input device comprising:

a classifying device that receives said data from said input line;

a routing device that routes said data from said classifying device to a multicasting device that generates a multicast copy of said data;

a segmenting device that segments said data; and

a multiplexer that multiplexes said segmented data into one of said plurality of prescribed ATM cells.

12. The system of claim 1, wherein said output device comprises:

a first multicast copier that receives and makes a multicast copy of each of said prescribed ATM cells;

a demultiplexer that deconstructs said ATM cells and transports said deconstructed ATM cells to one of a plurality of queues corresponding to output offsets of said output device;

a second multicast copier, in each of said plurality of queues, that makes a multicast copy of said transported, deconstructed ATM cells; and

a plurality of queues corresponding to a plurality of quality of service classes, that generate IP datagrams to corresponding output lines.

13. A method of transporting data, comprising:

determining whether cells received at an input port have a conforming status or a non-conforming status;

reserving a queue position for a conforming cell, followed by reserving a queue position for a non-conforming cell in said queue of said input port, until a predetermined number of said received cells has been reserved in said queue;

said input port generating and transmitting a request to a scheduler in accordance with results of said reserving step;

generating and transporting a supercell that comprises one of said conforming cells and said non-conforming cells in accordance with a grant received by said input device from said scheduler; and

receiving and deconstructing said supercell at an output device.

14. The method of claim 13, further comprising:

incrementing a conforming cell counter for each conforming cell received at said input device, and adding a queue number of said conforming cell to a first-in, first-out (FIFO) queuing list for conforming cells;

incrementing a non-conforming cell counter for each non-conforming cell received at said input device, and adding a queue number of said non-conforming cell to a first-in, first-out (FIFO) queuing list for non-conforming cells;

generating a queue that comprises one of said conforming cells and said non-conforming cells;

correspondingly sending one of a conforming cell request and a non-conforming cell request to said scheduler once said predetermined number of cells has been reserved for said queue, said scheduler generating said grant in accordance with said sending step; and

building one of a conforming supercell and a non-conforming supercell in accordance with said grant.

15. The method of claim 13, wherein a first said conforming cells comprise selected ones of said plurality of ATM cells that conform to a minimum cell rate (MCR), and said non-conforming cells comprise selected ones of said plurality of ATM cells that do not conform to said MCR.

16. The method of claim 15, wherein said generating step generates said at least one supercell comprising conforming cells prior to generating a supercell comprising nonconforming cells.

17. The method of claim 13, further comprising processing a plurality of quality of services classes in a plurality of queues at said input port, wherein said input port corresponds to an output port.

18. The method of claim 17, further comprising selecting said request for transmission to said scheduler in a port selector at said input port, receiving said grant, and generating said supercell in accordance with said grant.

19. The method of claim 13, wherein said system is configured to support multicasting.

20. The method of claim 13, further comprising generating a back pressure signal at said output device to said scheduler, and generating said grant in accordance with said back pressure signal.

21. The method of claim 13, wherein said generating said grant does not require header information for each of said plurality of cells.

22. The method of claim 13, wherein said input device transmits said request for a first of said two classes if said prescribed plurality of ATM cells conforming to a minimum cell rate has

been received by said input device, and said input device transmits said request for a second of said two classes if said prescribed plurality of ATM cells has been not conforming to said minimum cell rate has been received by said input device.

23. The method of claim 13, wherein receiving said cells at said input port comprises:

receiving and classifying said data from said input line;

routing said data from said classifying device to a multicasting device that generates a multicast copy of said data;

segmenting device said data in a segmenting device; and

multiplexing said segmented data into one of said plurality of prescribed ATM cells.

24. The method of claim 13, wherein said deconstructing step comprises:

receiving and making a first multicast copy of each of said prescribed ATM cells;

demultiplexing said ATM cells and transporting said demultiplexed ATM cells to one of a plurality of queues corresponding to output offsets of said output device;

making a second multicast copy in each of said plurality of queues, of said transported, deconstructed ATM cells; and

generating IP datagrams in said plurality of queues corresponding to a plurality of quality of service classes, for each of said corresponding output lines.

25. A system for transporting data, comprising:

an input port having a plurality of queues corresponding to a plurality of quality of service levels for a plurality of output ports, each of said queues receiving a plurality of cells of a first type and a second type; and

a scheduling module at said input port that receives cells from said plurality of queues at said input port and constructs supercells in accordance with a reservation vector for each of said queues, wherein non-empty ones of said plurality of queues has fair access to said scheduler, and said supercells are transported to said output port in accordance with a grant that is generated based on a request from said input port.

26. The system of claim 25, wherein said reservation vector reserves a corresponding time slot in a subsequent frame for said scheduling module and a corresponding one of said plurality of outputs.

27. The system of claim 26, wherein said reservation vector holds a reservation for a corresponding time slot in a frame following said subsequent frame if said corresponding time slot of said subsequent frame cannot be reserved for said scheduling module.

28. The system of claim 25, wherein said scheduling module comprises a computer readable medium having software configured to perform the following steps:

- (a) determining whether priority is held for a current time slot;
- (b) if said priority is held for said current time slot, determining whether said time slot is reserved by traffic conforming to said MCR;
- (c) if said time slot is reserved by traffic conforming to said MCR or if said priority is not held for said current time slot, performing the following steps:
 - (i) determining whether a current output queue is empty,
 - (ii) if said current output queue is not empty, determining whether said output port is available and not held by another input port,

(iii) if said current output queue is empty or said output port is not available or held by another input port, selecting a subsequent queue from a round robin list, and

(iv) if said output port is available and not held by another input port, reserving an output for said current time slot;

(d) if said time slot is not reserved by traffic conforming to said MCR, reserving an output with held priority and releasing holding priority for a next frame;

(e) after completion of one of step (d) and step (iv), performing the following steps:

(v) determining whether an output queue for said next frame is empty,

(vi) if said output queue for said next frame is not empty, determining whether said output port is available and not held by another input port,

(vii) if said output queue for said next frame is empty or said output port is not available or held by another input port, selecting said subsequent queue from a round robin list, and

(viii) if said output port is available and not held by another input port, reserving an output for said time slot in said next frame.

29. The system of claim 28, said software further performing the following steps:

starting from a head of a dynamic round robin list prior to performing at least one of step (i) and step (v); and

moving a reserved output to a back of said dynamic round robin list after performing at least one of steps (iv) and (viii), wherein said dynamic round robin is applied to select said subsequent queue in at least one of steps (iii) and (vii).

30. The system of claim 25, wherein said first type of cells conform to a minimum cell transport rate, and said second type of cells do not conform to said minimum cell transport rate.

31. The system of claim 30, wherein said first type of cells are constructed into supercells before said second type of cells.

32. The system of claim 25, wherein said fair access comprises equal time slot access for each of said non-empty queues.

33. A method of transporting data, comprising:

receiving data at an input device and generating cells;

classifying said cells into one of a conforming class and a non-conforming class, wherein said conforming class comprises cells that conform to a minimum cell rate (MCR) requirement;

transmitting a request from said input device to a scheduler;

in accordance with a grant from said scheduler, operating a scheduling module to provide fair access to a plurality of queues containing said cells at said input device, wherein said scheduling module controls transport of said cells from said input device to an output device; and deconstructing said cells at said output device and outputting IP datagrams.

34. The method of claim 33, said operating step comprising reserving said scheduling module for a prescribed queue for a time slot of a subsequent frame that is the same time slot as the current time frame.

35. The method of claim 34, wherein a reservation is held for a time slot of a frame after said subsequent frame and at the same time slot as the current frame when said time slot of said subsequent frame is not available for said prescribed queue.

36. The method of claim 33, further comprising generating a back pressure signal from said output device to said scheduler to control a cell transport rate for said method.

37. The method of claim 33, said scheduling step further comprising:

(a) determining whether priority is held for a current time slot;

(b) if said priority is held for said current time slot, determining whether said time slot is reserved by traffic conforming to said MCR;

(c) if said time slot is reserved by traffic conforming to said MCR or if said priority is not held for said current time slot, performing the following steps:

(i) determining whether a current output queue is empty,

(ii) if said current output queue is not empty, determining whether said output port is available and not held by another input port,

(iii) if said current output queue is empty or said output port is not available or held by another input port, selecting a subsequent queue from a round robin list, and

(iv) if said output port is available and not held by another input port, reserving an output for said current time slot;

(d) if said time slot is not reserved by traffic conforming to said MCR, reserving an output with held priority and releasing holding priority for a next frame;

(e) after completion of one of step (d) and step (iv), performing the following steps:

(v) determining whether an output queue for said next frame is empty,

(vi) if said output queue for said next frame is not empty, determining whether said output port is available and not held by another input port,

(vii) if said output queue for said next frame is empty or said output port is not available or held by another input port, selecting said subsequent queue from a round robin list, and

(viii) if said output port is available and not held by another input port, reserving an output for said time slot in said next frame.

38. The method of claim 37, further comprising:

starting from a head of a dynamic round robin list prior to performing at least one of step

(i) and step (v); and

moving a reserved output to a back of said dynamic round robin list after performing at least one of steps (iv) and (viii), wherein said dynamic round robin is applied to select said subsequent queue in at least one of steps (iii) and (vii).